



Cause and Effect of UL 1449 3rd Edition

Catastrophic failures of surge protection integrated in electrical switchgear/distribution equipment prompted the creation of a lobbying group which presented Underwriters' Laboratories (UL) with a request for additional safety testing to ensure controlled safe system failures.

In recent history, many switchgear/distribution manufacturers have made the decision to enter the surge protection market with their own brand of surge protection integrated into their core electrical equipment. Doing so enables them to capture market opportunities and expand their product offerings. To expedite this product expansion, a number of small independent businesses were acquired. Products were "value engineered" to reduce cost and to create product differentiation, offering the "gear manufacturers" their own unique brand of surge protection. Eliminating competition, these new brands of surge protection made a number of claims with unanticipated results.

Ref. Standards:
UL 1449 4th Ed.
UL 1283 5th Ed.
C62.41.1: 2002 IEEE
C62.41.2: 2002 IEEE
C62.45: 2002 IEEE
C62.62: 2010 IEEE
C62.72: 2007 IEEE
NEMA
NEC 2014
NFPA 70
FIPS 94
MIL-STD 220A

The Claim: Simple specifications i.e., use the electrical gear manufacturers' brand.

The End Results:

- Eliminated competition; locked customers to specific panel manufacturers' product which is typically a lower performance product.
- Customers paid inflated costs which were "hidden" in the cost of the electrical gear package.

The Claim: Direct bus connections/short leads, low impedance.

The End Results:

- Eliminated overcurrent protection caused a number of catastrophic surge protection failures, spraying ionized gas inside electrical distribution gear, creation of arc flash/contamination of distribution equipment/ultimate critical system shutdowns.

The catastrophic product failures focused an immediate and urgent request for further third party testing resulting in additional requirements being defined by UL 1449 2nd Edition 2.5 Revision (effective date February 2007) and a new standard UL 1449 3rd Edition (effective date September 2009).

New, much more rigorous test procedures mandated the ability of the surge protection devices to disconnect safely during abnormal current test levels of 10, 100, 500 and 1000 Amps (full rated test current flowing through the device). There were some "band aid" solutions used to pass these tests: (1) undersized fusing, (2) fuse links, and (3) thermal cutouts. All three of these solutions inherently restricted the ability to deliver full rated surge capacity. Most manufacturers chose to use two or, in some cases, all three solutions to pass UL 1449 3rd Edition.



Results of SPD/TVSS Catastrophic Failure/Arc Flash

During the time these surge protection failures were occurring, a new concept of Thermally Protected Metal Oxide Varistor (TpMOV) was developed. The new TpMOV presented the ability to "Fail Safe" under the new test requirements and to maintain 100% delivery of its full rated surge protection.

Determined *not* to use a performance limiting "band aid" solution, THOR SYSTEMS started a "ground-up" product redesign, utilizing a hybrid system integrating the TpMOV and expanding the product scope--all of this while maintaining the ability to deliver 100% surge rate "Fail Safe" surge protection devices.



THOR SYSTEMS, INC.

SURGE APPS SA-012: UL 1449 3RD EDITION CAUSE/EFFECT

(Guidelines and application tools to promote improved Power Quality)

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THOR SYSTEMS was the first surge protection manufacturer to apply for UL 1449 3rd Edition and completed all testing a full *two years before* the mandated effective date. At a recent Power Quality Presentation THOR SYSTEMS conducted for engineers, one of the participants commented, “The new UL 1449 3rd Edition takes the ‘astrology’ out of specifying surge protection.”

OTHER CONCERNS

- The main issue in mounting Surge Protective Device (SPD) products integral to the distribution equipment is the possibility of collateral damage to the distribution equipment in the event of a failure of the suppression unit.

The IEEE Green Book emphasizes this concern in Section 8.4.2.5. The standard also recommends a disconnect method for the suppression unit and further recommends the disconnect means should not require access to the equipment interior.

- Another concern surfacing with all of the arc flash discussions is the integral Surge Protective Device (SPD) requires the same Personal Protection Equipment (PPE) be used for access to the switchboard or panelboard. Because an integral device is within four feet of live parts, the same precautions must be taken to access the SPD as are required to access the distribution equipment. Thus, a switchboard with a PPE rating of **4** (the highest rating) would require the same equipment to be used to access the SPD.
- If the SPD is direct bussed to the distribution equipment, any SPD failure will result in the shutdown of the entire panel feeding the SPD. All coordination within the system will be lost.
- By the same nature as the bullet above, the entire distribution section must be shut down to service the SPD.
- Surge protection is *not* the primary business of the electrical gear manufacturers.
- Lead length is touted as being less on integral units. In many cases, due to the placement of the SPD, the neutral and ground leads actually end up being much longer than the external SPD.



THOR SYSTEMS Series TSn
Non-modular 150kA/Mode SPD fed by 3P 30A
Panel Mounted Circuit Breaker
(Clear Status Indication, NEMA 4X,
Indoor or Outdoor Application)



THOR SYSTEMS Series TSr 300
Modular SPD Mounted on Top of
Service Entrance Switchgear

We would like to become an information resource for surge protection applications. THOR SYSTEMS offers products and services that provide protection from the more *obvious external* to the more *frequent internal* transient voltage sources.

Ref. Documents:

TSI 068 Product Overview
TSI 102 SPD Standard Changes, UL 1449 3RD Ed.
TSI 101 Suggestions to Update Specs to
UL 1449 3rd Edition
TSI 068UL 1449 3rd EDITION CHANGES
TSI 107 Design/Build Spec

Should you have any questions, please feel free to contact us (804.355.1100) or visit our Web site, www.ThorSystems.us.